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IOT- Assisted Smart Driverless Vehicle with Cognitive Abilities

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ABSTRACT – This paper shows design and implementation of line following, lane changing, obstacle avoiding with multiple sensors and accident detection, rash driving alerting robot. The Line Follower and lane changing Robot's capacity to choose the required line from among the black and white lines is demonstrated in this article along with its design and implementation. This may be coupled with many colour s. Since each colour has a unique characteristic, a robot can readily distinguish between them. It also has the capacity to identify obstacles and take an alternate route to its destination. The robot, which detects a line and tries to move in the direction of the target, is designed to receive instructions. As it continually receives data from the sensors, the robot can drive around highly crowded bends with ease. This robot can detect collisions with an obstacle sensor and avoid them, so it can reach the target. Vehicle Detection with GPS and GSM modem is designed to avoid delays in getting medical help to victims of accidents on the roads. The proposed system can be implemented in vehicles and in any commercial, industrial, medical and also in educational labs.

KEYWORDS - Arduino, IR Sensor, Ultrasonic Sensor, GPS and GSM modem, IOT, ESP8266

I. INTRODUCTION

The Line Following Robot is an autonomous machine that uses an attached IR sensor to identify a line and then follows it in accordance with the sketched path. To prevent any detecting errors, the route can be either a blackline painted over a white surface or a white line drawn over a black surface. A line follower robot also has an obstacle sensor that may identify any obstacles in its path before they cause an accident. A line follower robot is created and programmed such that it follows the path that has been provided and completes its task flawlessly. It works by detecting the route, reading it, and sending the signal to an Arduino UNO. The microcontroller makes any necessary adjustments to the robot's directions or speeds in response to the inputs it receives. So it transmits the command signal to the line follower robot's speed and direction. The line follower robot is able to function flawlessly in this manner. A line follower robot with object identification capabilities is equipped with an ultrasonic sensor, a tool that uses sound waves to gauge the separation between an item and the robot. By emitting a sound wave at a particular frequency and listening for the reflected sound, it determines the separation between the line- following robot and the obstruction. It's critical to realise that some things may not be picked up by an ultrasonic sensor.

An alarm and identification system for reckless driving and vehicle accidents utilising NodeMCU. It features a completely working and autonomous circuitry, in contrast to other initiatives on the internet. It effectively combines the strengths of the NodeMCU, Ublox Neo-6M GPS module, and Invensense's MPU6050. The MPU6050 combines a gyroscope and an accelerometer, with one module providing data to the other to assist it overcome its limitations. In contrast to gyroscopes, which record rotational velocity across an axis, accelerometers measure acceleration over three axes. The NMEA format, which the GPS module encodes, may be utilised to pinpoint the

precise position of the misfortune. Additionally, a letter is also delivered via an API request integrated with the google link to the registered mail address. We may send mail with the aid of IFTTT, a tool that connects many services. The user receives the notice in the email, along with the accident's location. If you wish to follow the whereabouts of the car in real-time, you can also have a look at the IoT-based Vehicle tracking project.

This project has uses in the military, delivery services, transportation systems, and applications for the blind.



II. LITERATURE SURVEY

The author [1] proposes a strategy for achieving secure, polished, and appropriate broad unified lane change in response to an unexpected road barrier. In this method, a CV that identifies an obstruction quickly alerts the following cars via Vehicle to Vehicle communication. In turn, the vehicles listed below can take step to seamlessly keep away from the obstruction using a broad extent beyond the impediment without losing security or ride pleasure. In this method, a vehicle that senses an impediment utilises multi-hop Vehicle to vehicle communication to transmit the obstruction's location with cars beyond it over a long distance.

The author [2] proposed technology for obstacle detection, and when there is an obstruction in front of it, the output changes significantly more than when it is free of obstacles. In line following mode, the sensor detects a white line on a black surface. The dark route is continually tracked by three sensors at the bottom of the robot. When the left sensor detects a white surface, the left wheel slows and the right wheel turns. The same thing happens when the right wheel detects a white surface. When both sensors detect a black line, the vehicle continues straight with both wheels turning at the same speed.

This article envisions the use of autonomous cars on a two-lane road section before a crucial position. The technique consists of two basic algorithms. The first algorithm manages lane changes for a single car in the least amount of time while maintaining a safe distance from all nearby vehicles. [3]

The theory of the line follower robot is effectively built in this study by author [4] using an electrical logic circuit and sensors. Simultaneously executes physical motions using instructions from sensors and on-board logic circuitry. The robot successfully located and followed the spot. This robot can track colours' other than black and white. If the conditions are correctly specified and the computations are correct.

The proposed [5] study provides a unique real-time optimal-drivable-region and lane recognition method for self driving based on the combination of LIDAR and visual data. To cover the most drivable regions in front of a vehicle, our technology employs a multisensory approach. For LIDAR and vision data, as well as an optimum selection strategy for determining the best drivable zone provided by approach of feature - level fusion.

This study assumes that the [6] vehicle can follow the track, pass other cars, identify hazards, make abrupt curves and turns, obey traffic signals, and switch on its lights in low-light settings. The autonomous automobile model provided in this research study aims to address these concerns by removing humans from the driving seat. so that people no longer have to drive and the danger of accidents, being late, and traffic jams is minimized to a bare minimum.

The suggested [7] paper by the author gives a current review of technologies and extant solutions for detection of obstacle . We especially examine the performance of LIDAR, , vision cameras, RADAR ultrasonic sensors, and infrared sensors, as well as their capacity and behaviour in a variety of situations, including daytime, night time, utmost weather conditions, urban areas, the existence of smooth surfaces, situations where emergency service vehicles must be detected and recognized, and situations where potholes must be observed and measured. It has

III. METHODOLOGY

Our aim is to build a system for unmanned vehicle navigation in challenging road conditions using active sensing by ultrasonic, IR sensors. IoT-assisted smart vehicle is used for optimal obstacle detection, and accident alert, and then conditional lane detection and track following method get applied accordingly. This proposed system ensures that the vehicle is driven safely in any kind of road condition and provides the strategy for the detection of the best drivable region.

3.1 Architecture of the system:

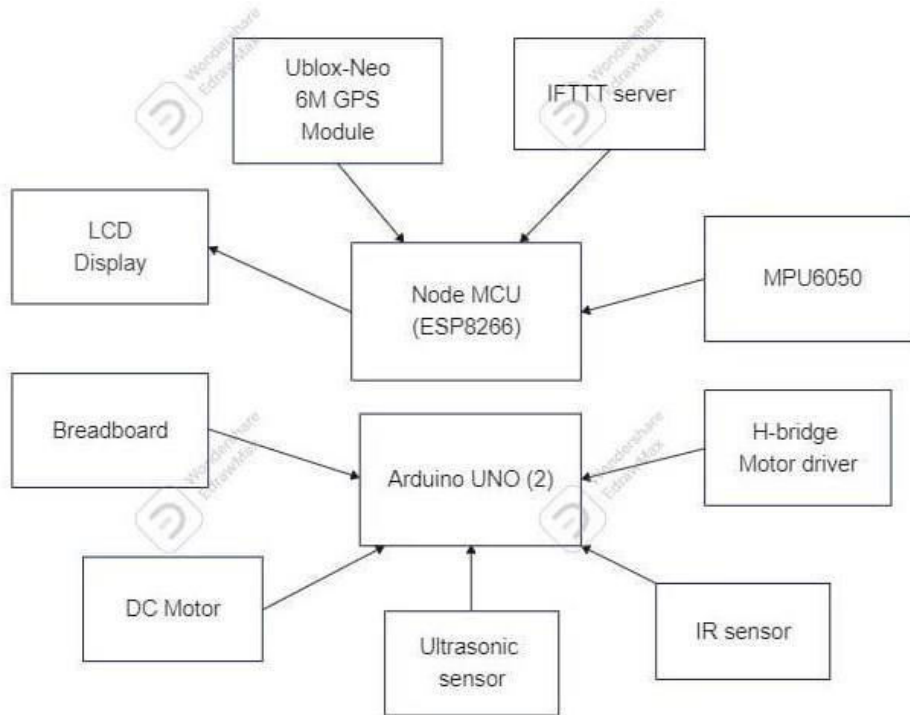


Fig.1 Architecture

3.2 Working:

A. Obstacle avoidance and Lane changing feature: The system uses 2 types of sensors:
 Ultrasonic sensors – To detect the obstacle.
 IR sensor – To change the lane and follow the track.

This smart vehicle detects the obstacle using 5 Ultrasonic sensors located 1 in the front side, 2 on the diagonal side, and 2 in horizontal directions as well. The vehicle follows the line after overcoming the obstacle and also detects the depth in the path after changing the path due to the obstacle in order to avoid any damage. After that, it'll continue to move on the safe path furthermore.

B. Rash driving and Accident alert:

This circuitry combines the features of Invensense’s MPU6050, Ublox Neo-6M GPS module with Node-MCU to a great effect. MPU6050 is a combination of the accelerometer and the gyroscope, with both modules help the other with the data to overcome the shortcomings. The accelerometer records the acceleration across 3 axes, whereas the gyroscope records the rotational velocity across the axis. The GPS module encodes the data in the form of NMEA format, which can be used to carve out the exact location of the misfortune. In addition to that, the mail is also sent to the registered mail id through an API call embedded with the google link. A service called IFTTT connects different services to help us send mail. The email conveys the message and also sends the location of the accident to the user.

3. Tools and Technology:

a. Node-MCU is the microcontroller board with wi-fi capability. It uses an ESP8266 microprocessor chip and its hardware basically runs on the ESP12 module.



- b. Ultrasonic Sensor is a device that can measure the distance of an object by using sound waves. The distance between the sensor and the item can be determined by keeping track of how long it takes for the sound wave to generate and bounce back.
- c. MPU6050 device can able to measure both accelerometer and gyroscopic values across 3 axes with the help of registers built inside of it. It captures the change in position and generates a voltage which is further connected to ADC and is transmitted to the buffer and data gets communicated to MCU using I2C protocol.
- d. Neo 6M GPS Module is considered as a suitable and affordable receiver having features such as authentic memory options, low power consumption, and the best architecture.
- e. OLED (Organic Light Emitting Diode) display has the ability of self-illumination which makes it to be thinner compared to other technologies. Better quality of graphics and power efficiency make it suited for IoT applications.

Email Alert and IFTTT:

IFTTT is a free web-based service, that allows users to create applets with simple conditional statements. The event is normally triggered by an API call. The API call contains the API key, hostname, port, event name, and the values to be passed. We have built an applet that can send mail to the owner of the vehicle with its GPS location attached. The framework is designed and implemented in C++ using the Arduino software. Arduino is an open-source integrated development platform, and it can be used to write and upload code to Node-MCU. The vehicle follows the line after overcoming the obstacle and also detects the depth in the path after changing the path due to the obstacle in order to avoid any damage to the vehicle.

4. Circuit Diagram:

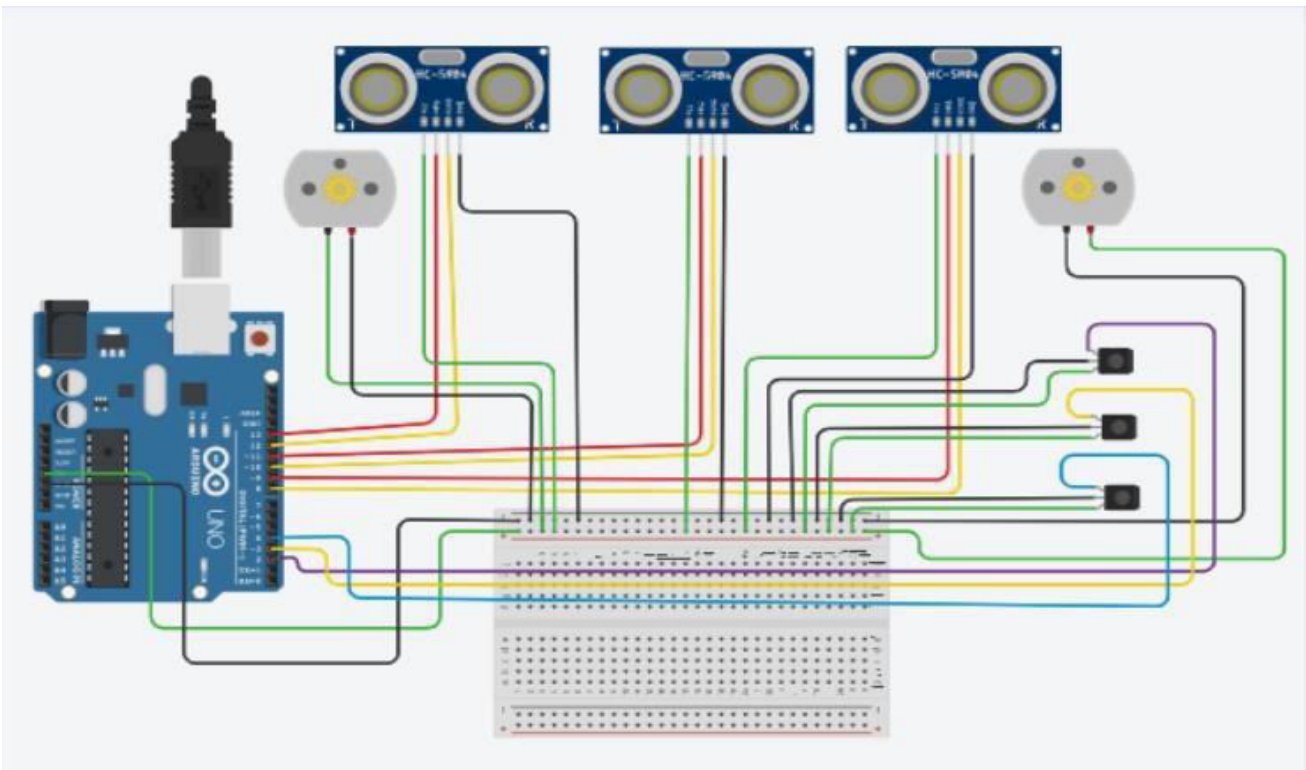


Fig. 2 Circuit Diagram



IV. RESULTS AND DISCUSSION

4.1. OBSERVATIONS

In this project, we must give 12 v power supply to DC motor to run our model. Instead of ultrasonic and IR sensor we can use LIDAR sensor for better accuracy, but it's use is costly. Our model is cost effective we use five ultrasonic sensor and IR sensor to monitor 360-degree views. Rash driving is separate feature included in our model which has no connection with our main development board. Which mainly based on MPU6050(Gyroscope and Accelerometer) readings. As shown following change in axis occurred sensor detects that.

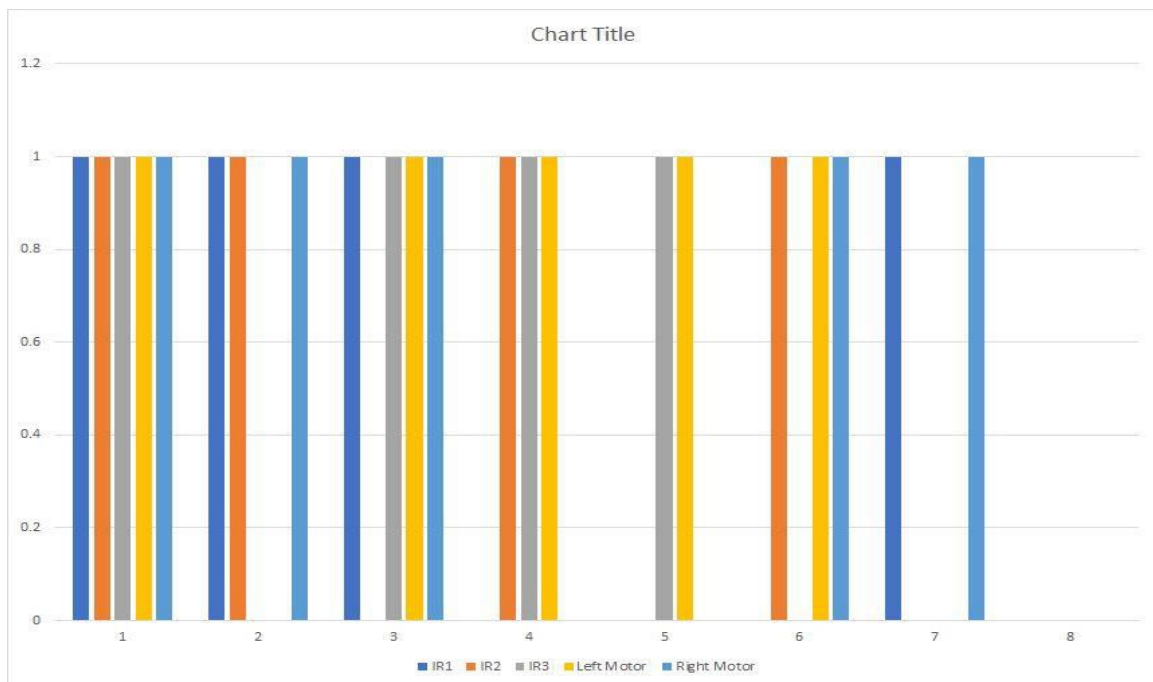


Fig. 3 chart for line following.

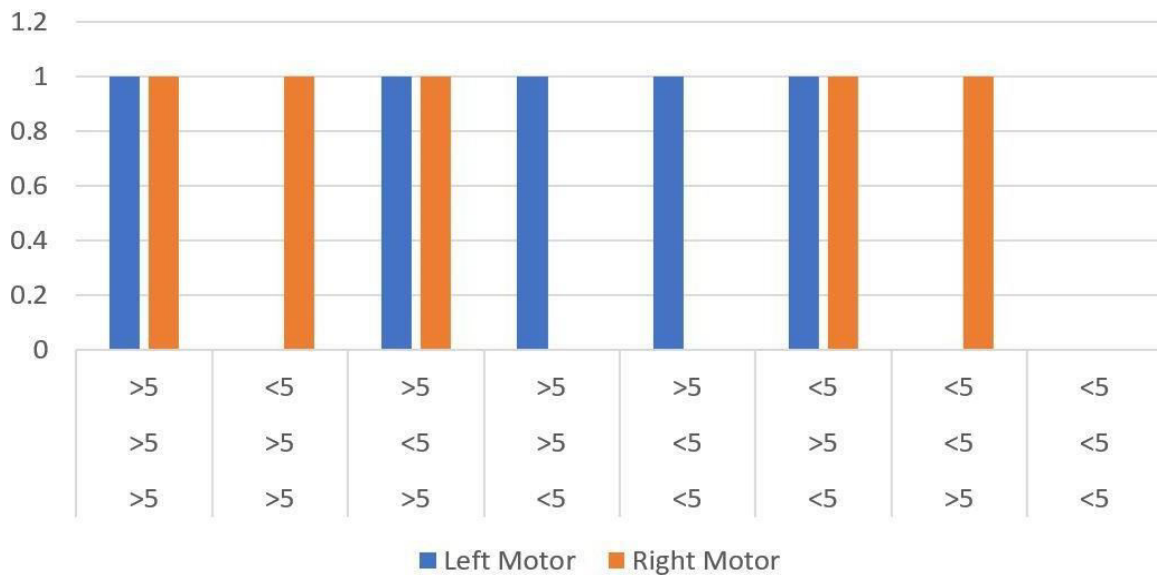


Fig. 4 chart for obstacle Avoiding.

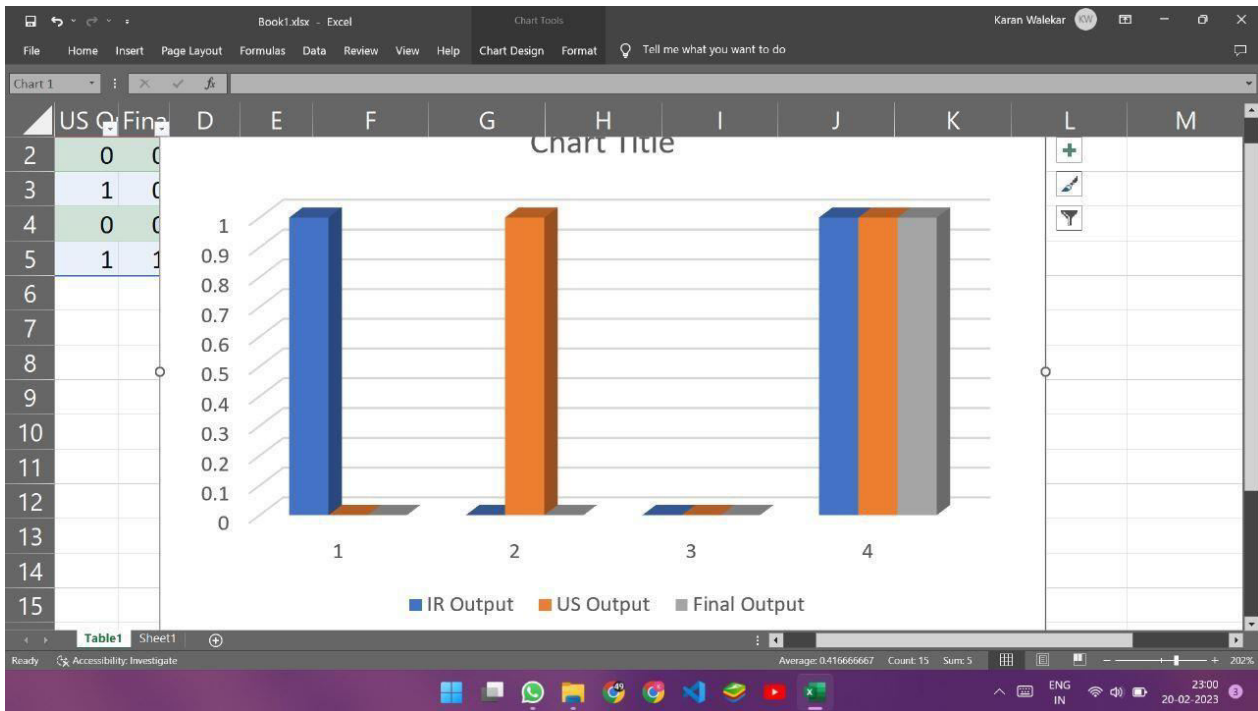


Fig.5 Combined output of US and IR

V. CONCLUSION

We here make use two development boards (Arduino and Node-MCU) for prototyping our model. Different Connection which makes different features of our model are internally attached with these two boards. The device is automated, and it precisely monitors lane and avoid obstacle surroundings. This system uses data from ultrasonic sensors, IR sensor, MPU6050 for obstacles preventing, lane detection over speeding of the vehicle. The project allowed us to examine the existing methods, their advantages, disadvantages, and the design of a system for monitoring automation levels.

VI. FUTURE SCOPE

For the next work, the system can anticipate its behaviour using deep learning and machine learning, and Artificial intelligence n can also be used to make model more automate for all that task which requires human intervention. We can implement zebra crossing feature, Signal sensing feature here as well.

The system may also be modified so that the Driver can operate it via Android application. In the future, the system may potentially incorporate automated driving application.

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